

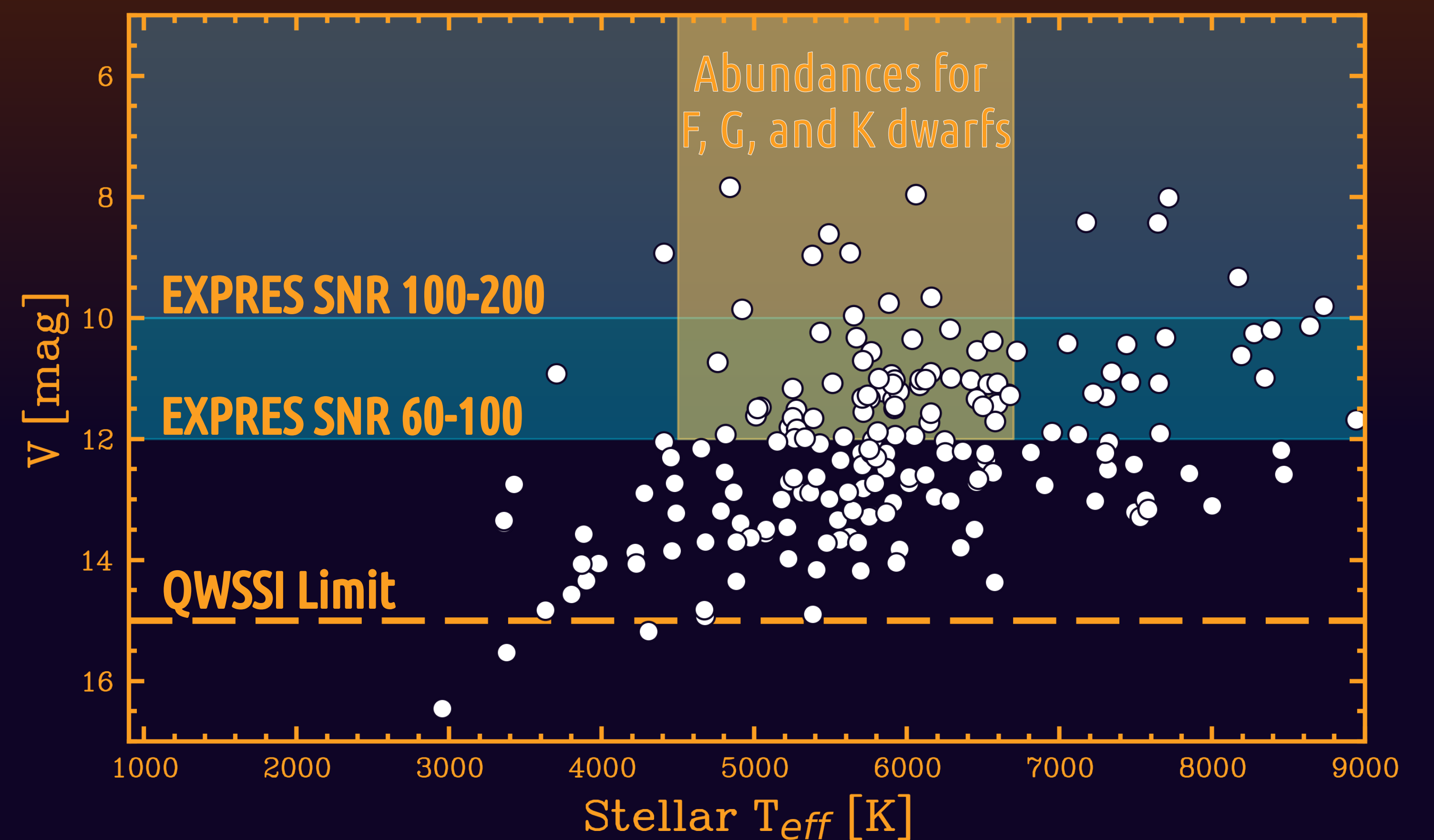
PLANET CONFIRMATION IN THE SOUTHWEST



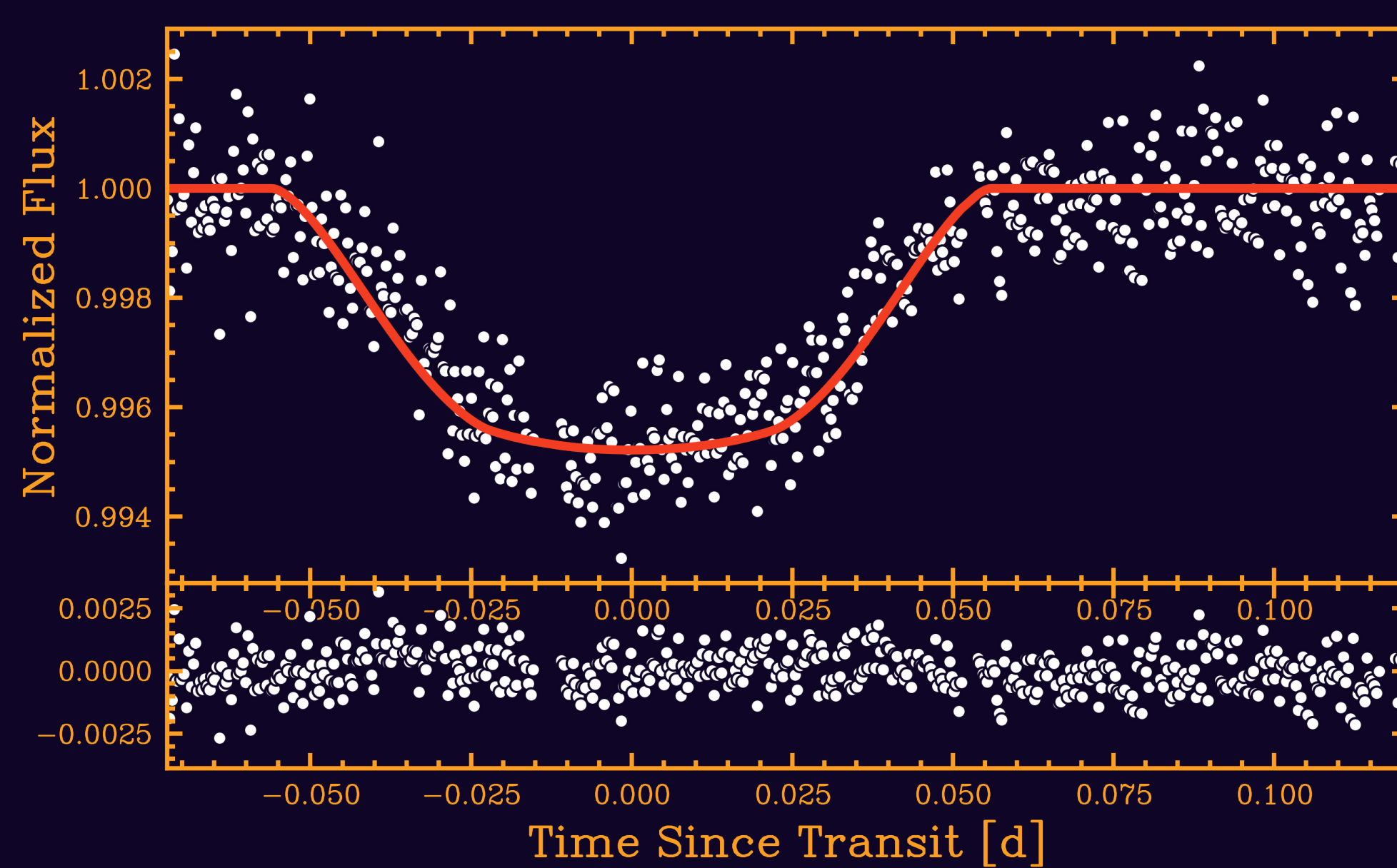
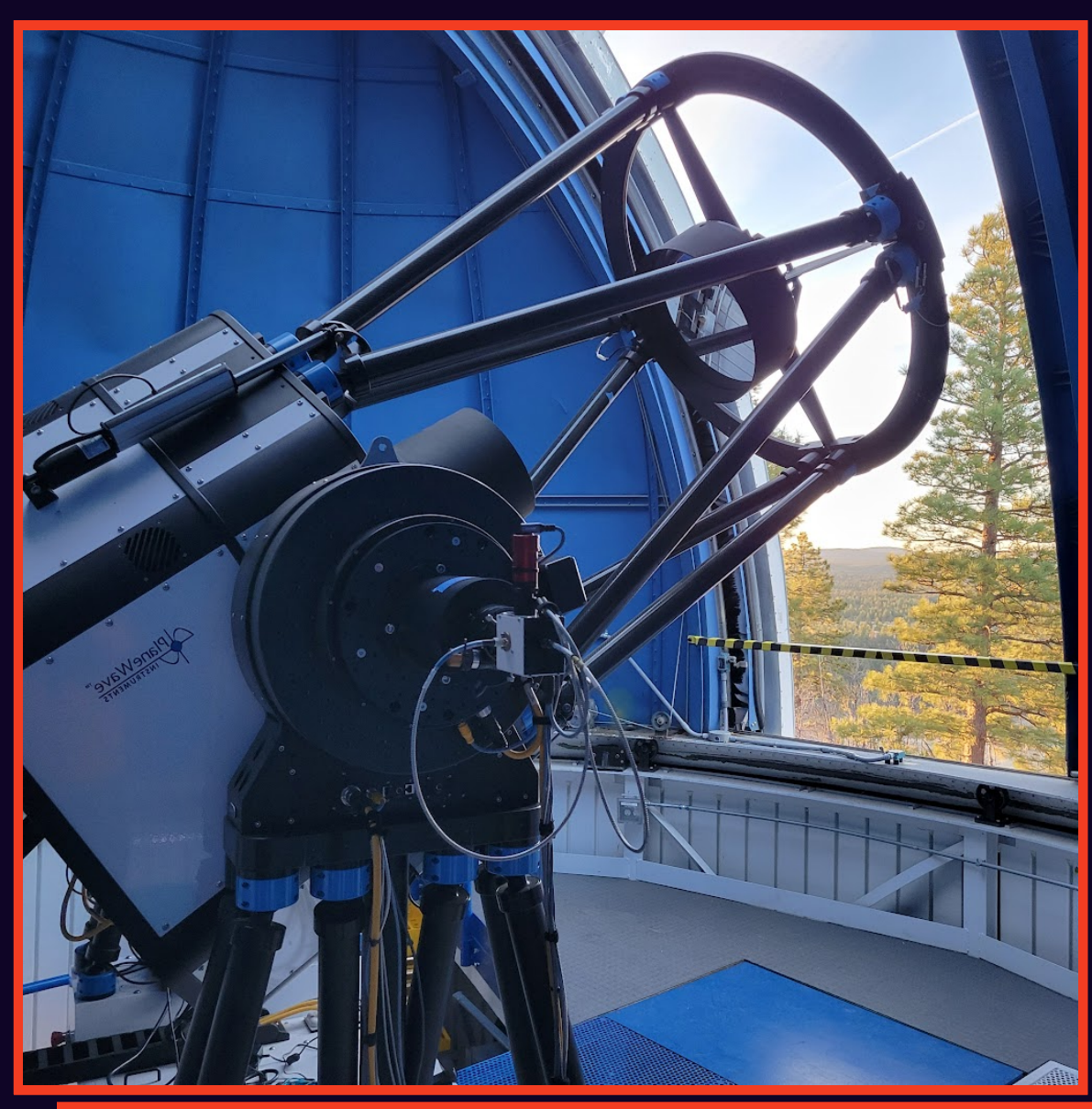
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The Ariel mission is poised to conduct the largest survey of exoplanet atmospheres to date and will be transformative in our understanding atmospheric trends at the population-wide level. However, the stated mission goal of observing the atmospheres of 1,000 exoplanets faces a critical bottleneck: the lack of targets amenable to atmospheric characterization. Despite the impressive progress made by the community in confirming more than 6,000 exoplanets, many of these have properties that make emission/transmission spectroscopy difficult. Luckily, many thousands of additional planet candidates, primarily from the TESS mission, still await confirmation.

Lowell Observatory (Flagstaff, Arizona) operates a number of facilities well-suited for providing the follow-up observations necessary for planet confirmation.



PHOTOMETRY



The Peggy & Eric Johnson 1-Meter telescope is a Planewave Instruments PW1000 corrected Dall-Kirkham paired with a Moravian C3-61000 Pro camera. This imaging system offers a 20' x 15' FOV. In an effort to keep orbital ephemerides updated, PJ1M is being used to observe the transit of an Ariel TOI or known planet nearly every night.

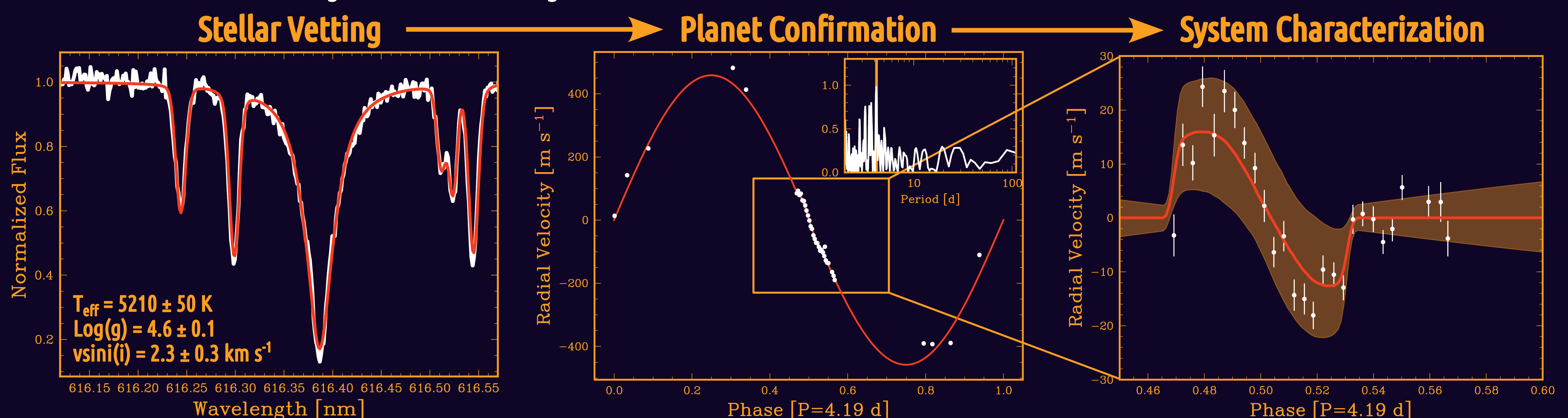
Figure: 4.5 mmag transit of the near-grazing ($b=0.9$, Khandelwal et al. 2022) TOI-1789 b as observed with PJ1M. The residuals to the model have an RMS of ~ 0.9 mmag.

HIGH-RES IMAGING/SPECTROSCOPY

Situated two hours south of Flagstaff, the 4.3-meter Lowell Discovery telescope (LDT) hosts both the EXtreme Precision Spectrograph (EXPRES) and Quad-Wavefront Six-channel Speckle Interferometer (QWSSI). QWSSI will survey all northern Ariel TOIs down to $V \sim 15$ mag, to vet for close stellar companions up to a Δ mag of 6 in four optical channels. EXPRES offers $R \sim 137k$ spectroscopy and is capable of radial velocity stability of 50 cm/s. For brighter TOIs ($V < 12$ mag), EXPRES will provide precise stellar parameters and mass constraints for stars amenable to precision RV follow-up. In addition, we will provide obliquity measurements for a sub-set of Ariel targets.



Figure, top: A reconstructed QWSSI image of HIP 24819 showing a tertiary companion to the secondary component separated by just 0.3". Bottom (right): An EXPRES spectrum of a representative TOI ($V = 10.6$ mag). The red line is the Spectroscopy Made Easy model used to derive stellar parameters. (middle) EXPRES radial velocities of TOI-6971.01 confirming a 3.7 Jupiter mass planet. (right) Zoom-in of the previous panel on the in-transit radial velocities detecting the Rossiter-McLaughlin effect.



Lowell Observatory sits at the base of mountains sacred to the various Native American tribes of Northern Arizona. We honor their past, present, and future generations, who have lived here for millennia and will forever call this place home. It is a privilege to practice astronomy on these lands.